THE RELATIONSHIP OF THE EPIDEMIOLOGIST TO WATER WORKS MEN[1]

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We may define epidemiology as a study of the factors influencing the transmission of the communicable diseases. Its scope includes the microörganisms causing disease, their means of transmission from one individual to another and of the opportunities that facilitate or hinder transmission. This knowledge may be effectively applied in disease prevention and eradication.

Water works men are chiefly interested in the part that public water supplies may play in the transfer of infection. The microorganisms causing typhoid fever, asiatic cholera and dysentery, and perhaps some other communicable diseases, may be transmitted by infected water supplies, but to us, as dwellers in the temperate belt, typhoid fever is the most important, and is from a practical standpoint the only disease we encounter which may be transmitted through water.

Before considering the characteristics of water-borne typhoid fever, it might be well to state some fundamental facts regarding the origin and spread of the disease. Typhoid fever is an infectious disease caused by the bacillus typhosus. This organism never develops spontaneously, but always has its origin from the discharges of some previous case of typhoid fever or a carrier of the organism, who is usually a person that has recovered from the disease, and in whose body certain poorly understood biological relationships exist that permit him to continue to harbor the typhoid bacillus and discharge it intermittently in his feces and urine. From such sources of infection the typhoid bacillus may be transferred to susceptible persons through the routes of infection of contact, water, milk, ice cream, uncooked and cold foods, flies and some other relatively insignificant routes of infection. An inquiry into the prevalence of

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typhoid fever, therefore, has to consider the opportunities which have existed for the infection of these substances, consumed by the patients at the probable time of infection.

Public water supplies may be either continuously or intermittently infected with the typhoid bacillus. The source of supply may become contaminated from the sewage of other towns, from the sewage of the same city, from the waste of individual houses, institutions or factories, from privies situated directly on or over the banks of the source of supply, or excrement which has been deposited on the ground being washed into a water course by rain or by seepage; or the supply may become infected through the temporary admission into mains of water from a contaminated source at the time of some accident or emergency. Where infection is continuous the source of supply is heavily polluted with sewage the year round. Its effect is manifest by a very high typhoid fever case rate and death rate extending throughout the year; in other words as an epidemic of long duration. Where the infection is intermittent or temporary the disease outbreak appears as an explosive epidemic from two to four weeks after the temporary contamination occurred. Moreover, epidemics due to temporary infection present certain distinctive characteristics. In a temporary infection of a water supply the infection is generally rather dilute, unless a grossly polluted source of supply has been temporarily substituted. The typhoid bacillus does not find water a favorable medium for its continued growth and multiplication and gradually diminishes in numbers until finally extinct. This characteristic is well known and used in the purification of water by storage. The decrease in the numbers of the typhoid bacillus takes place more rapidly in the summer months than in the winter. Most large water-borne epidemics have occurred in northern cities, both in this country and Europe and nearly always occur in the spring, fall or winter when the water is cold. The number of cases developing daily shows a rapid rise, soon reaches a maximum and rapidly declines; in other words the epidemic is explosive. The contamination of the water is usually nearby, and the transfer of virulent organisms is fairly rapid.

In the investigation of a typhoid epidemic where the evidence collected indicates infection from a contaminated water supply, we generally find something like the following: All or nearly all cases will give a history of the use of the suspected water at about the approximate time of infection, for drinking, or have eaten raw

vegetables washed in it, or used it in washing the mouth. In public supplies the infection will be distributed uniformly through the population regardless of age and sex and largely coincide with the limits of the water supply. Cases living outside the limits of the supply will usually be found to have used the water at school or place of business or elsewhere. When private supplies are infected the distribution of cases is generally localized and confined among those of a particular nationality, age group, sex or occupation, etc. These are but a few of the characteristics of a water-borne outbreak of disease.

While water-borne typhoid is of very common occurrence, it is not the sole or chief cause of typhoid and is playing a rapidly diminishing rôle in the spread of the typhoid bacillus. The great water-borne epidemics have overshadowed other means of infection. The larger part of the typhoid fever prevalent is not water-borne. In 1908 Whipple estimated that 35 per cent of the cases were contracted from water, and at present the percentage must be much less. Typhoid fever may be excessively prevalent, even epidemic in a city having a water supply of a good sanitary character.

Every water works superintendent should keep constantly posted on the current prevalence of typhoid fever in the city or town he serves, and at the first manifestation of an undue increase in the disease should insist that the local board of health institute an epidemiological investigation of the disease. Furthermore, every public water supply, no matter what its sanitary quality, should be equipped with either a hypochlorite or liquid chlorine sterilization plant, for continuous or emergency use. An installation for the use of hypochlorite will probably be found the most economical to install and can be constructed by the water works force. Then at any time, should emergency compel the use of water of doubtful source, the health of the community can be safeguarded by sterilization of the water.